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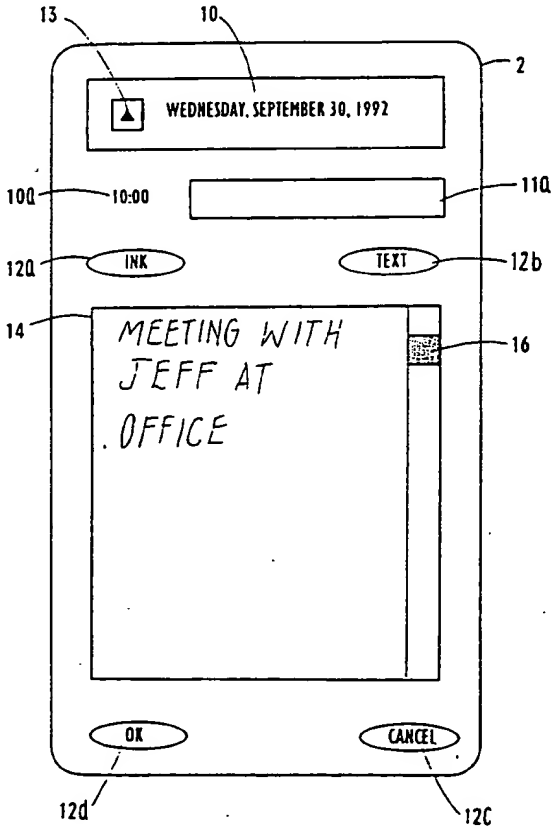
(57) Abstract

A data input system (3) ideally suited for pen-based portable computers (1) having a limited writing area. A user selects a pre-defined data display field (11), whereupon an enlarged ink input field (14) is displayed. The user may select whether the ink input is to be saved as an ink data type, or recognized and converted to text characters. If the user accepts the ink input as an ink data type, then the ink is reduced sufficiently to fit within the original data display field, and the data display field (11) is automatically resized to accommodate the ink that was entered in the enlarged ink input field (14). If the user accepts the ink input for recognition, then the computer recognizes the ink input as text characters, and displays the text characters in the data display field (11). Reduced ink input may be processed at a later time to recognize the ink input as text characters.



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DATA INPUT SYSTEM FOR PEN-BASED COMPUTERS

BACKGROUND OF THE INVENTION

1. *Field of the Invention*

This invention relates to computers, and more particular, to a data input system for pen-based portable computers.

2. *Description of Related Art*

As computers have become increasingly popular for various applications, portable computers have been developed for a wide variety of uses. While many such portable computers use a traditional keyboard for input, for smaller computers, particularly including hand-held computers, the use of "pens" as an interface has been introduced as a way of making a small computer easier to use. With a pen interface, a user can place a pen or stylus directly on a touch-sensitive screen of the computer to control the software running on the computer and to input information. For many people, writing with a pen is a more natural way of inputing information than using a keyboard.

An example of a prior art pen-based hand-held computer is shown in FIGURE 1. The illustrated hand-held computer 1 is typically about 4 inches by 6.5 inches, with the majority of one surface comprising a touch-sensitive display screen 2. The display screen 2 is typically a liquid crystal display (LCD) having a resolution of 240x320 pixels or greater (although larger or smaller pixel arrays could be used). Various technologies can be used to sense the location of a pen or stylus 3 touched against the surface of the LCD screen 2 to indicate to the computer's operating system the X-Y coordinates of the touch. Such a computer may be provided with an option slot 4, which may be, for example, a PCMCIA-compliant adapter slot. Various hardware buttons 5 may b provided to control different functions, and/or to turn power on or

off to the unit. In addition, a variety of software buttons or icons 6 may be provided, in known fashion, to indicate such functions as, for xample, word processing or a delete ("trash can") function. Computer-generated information is typically shown on the display screen 2 as ASCII characters 7. Data input is typically received and/or displayed in specific fields 8.

A common characteristic of such pen-based computers is the use of character recognition software to convert "ink" characters input by a user into computer readable text, such as ASCII characters. "Ink" comprises a series or trail of pixels changed (e.g., darkened or lightened) as a pen 3 is moved across the display screen 2 by a user, thus mimicking the application of real ink to paper. One such character recognition system is described in U.S. Patent No. 5,125,039, entitled "Object Recognition System", by the inventor of the present invention. In such systems, as a user inputs each ink character, or after several ink characters have been input, the computer applies special algorithms to recognize each character as an ASCII character, and replaces the ink representation of the character drawn by the user with a standardized ASCII representation of that character.

Despite the functional capability of such hand-held pen-based computers, in actual practice, writing with a pen on the small displays of such computers has proven to have several drawbacks that make pen-based computers difficult to use.

One problem is that state-of-art hand writing recognition software works well for some people, but does not work well for other people, since individual hand printing styles vary significantly. In general, the error rate of such software is high. In particular, such software does not work well at all if the user inputs text in a sloppy fashion or in script, rather than in printed form.

To overcome the limitations of hand writing recognition software, designers of pen-based computers have started saving the user's original input strokes as a graphical

"ink" data type, without trying to convert the input strokes into ASCII text. In this scheme, when a user writes on the screen, the computer makes no attempt to recognize what was written. Instead, the information is saved as a graphics image representing the path of the pen 3 across the display screen 2. The graphical ink image may be represented, for example, as a bit-mapped, vector, or algorithmic representation of the input strokes.

While such "unrecognized" ink is very fast and easy to input, it is less useful than ink that has been recognized as text. Because unrecognized graphical ink input is unstructured and has no meaning or associations to the computer, the computer cannot perform searches on or use ink data types in intelligent ways. Thus, later use of such input is severely restricted. To overcome this significant limitation, some computer designs allow the user to assign key words to a block of ink input. This requires extra steps by the user in anticipation of future needs, and has limited utility.

Another problem of both recognized and unrecognized ink input on pen-based computers is the amount of screen space required to accept ink input. The screen digitizers used to determine the location of the pen or stylus 3 on the display screen 3 have limited resolution, and are "noisy" (meaning that they do not always track accurately the position of the pen). Further, the display screens 2 have limited resolution. For good character recognition and to enable the capture of clear ink input from a user, the user has to write fairly large letters to overcome the limitations of the digitizer and display screen. Unfortunately, this need for a large writing area conflicts with the desire for creating small hand-held computers. A hand-held computer might have a display measuring only about 2½ by 3 inches. With a normal handwriting style, the user can only write one or two lines of ink on such a small display. To date, this characteristic has been a hinderance in the design and acceptance of such small computers.

Accordingly, a need xists for a more effective method of writing information with a pen on small-display pen-based computers. In particular, a need exists for accommodating input from a wide-variety of users on a pen-based, hand-held computer having a limited writing area.

The present invention provides such a method.

SUMMARY OF THE INVENTION

The present invention comprises a data input system ideally suited for pen-based portable computers having a limited writing area. A hand-held computer using the invention permits a user to select a pre-defined data display field, whereupon an enlarged ink input field is displayed to the user. The computer accepts ink input from the user into the enlarged ink input field. The enlarged ink input field may be scrollable, automatically or manually, to present additional "blank" writing area to the user.

The user has the option of selecting whether the ink input is to be saved as an ink data type, or recognized and converted to text characters. If the user accepts the ink input as an ink data type, then the computer shrinks (reduces) the ink input to fit within the original data display field and displays the reduced ink input in the original data display field. In the preferred embodiment, the ink is reduced sufficiently (typically 2:1) to fit within the width of the original data display field, and the height of the data display field is automatically resized to accommodate all of the ink that was entered in the enlarged ink input field. Alternatively, the original data display field may indicate, by means of a scroll icon or similar means, that the field contains additional non-displayed ink input. Activating the indicator allows the user to scroll the reduced ink input in the data display field.

If the user accepts the ink input for recognition, then the computer recognizes the ink input as text characters, and displays the text characters in the input field. When done inputing into the input field, the user closes the enlarged ink input field, and the recognized text is displayed in the data display field. As an option, reduced ink input may be processed at a later time to recognize the ink input as text characters.

Thus, the invention allows a user to enter data quickly into a larger writing field but display the data in a smaller viewing field. The ink data is useful to the us r and the

computer because the data is entered into defined input fields, and thus a context is automatically associated with the data. Further, the invention permits a user to enter data as rapidly as the user can write, and convert the data to text characters at a later time.

The details of the preferred embodiment of the present invention are set forth in the accompanying drawings and the description below. Once the details of the invention are known, numerous additional innovations and changes will become obvious to one skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a front left-side perspective drawing showing a prior art pen-based hand-held computer.

FIGURE 2 is a front plan view of a display screen of a pen-based hand-held computer showing example labels, data fields, and button icons.

FIGURE 3A is a front plan view of the display screen of the computer of FIGURE 2, showing an enlarged ink input field.

FIGURE 3B is a front plan view of the display screen of the computer of FIGURE 2, showing an alternative embodiment of an enlarged ink input field.

FIGURE 4A is a front plan view of a display screen showing a subsequent view of the screen shown in FIGURE 3, showing multiple rows of reduced ink input obtained from the enlarged ink input field of FIGURE 3.

FIGURE 4B is a front plan view of a display screen showing a subsequent view of the screen shown in FIGURE 3, showing a data display field with partially displayed reduced ink input obtained from the enlarged ink input field of FIGURE 3.

FIGURE 4C is a front plan view of a display screen showing a subsequent view of the screen shown in FIGURE 3, showing a data display field with partially displayed reduced ink input obtained from the enlarged ink input field of FIGURE 3.

FIGURE 5 is a front plan view of a display screen showing a subsequent view of the screen shown in FIGURE 4, showing the converted form of the reduced ink input of FIGURE 4.

FIGURES 6A and 6B are flow charts describing a first embodiment of the inventive process of the present invention.

FIGURE 7 is a flow chart describing a second embodiment of the inventive process of the present invention.

Like reference numbers and designations in the various drawings refer to like elements.

DETAILED DESCRIPTION OF THE INVENTION

Throughout this description, the preferred embodiment and examples shown should be considered as exemplars, rather than as limitations on the present invention.

FIGURE 2 is a front plan view of a display screen 2 of a pen-based hand-held computer 1 showing example labels 10, pre-defined data display fields or windows 11, and "soft" buttons or icons 12. For purposes of illustration only, the invention is described in the context of a particular application, comprising a scheduling function. However, the invention can be used with any other application that involves entering data into defined data display fields 11.

Referring to FIGURE 2, the scheduling application shows six data display fields 11 opposite six corresponding labels for hours of the day, ranging from 10:00 a.m. to 3:00 p.m. The label field 10 at the top of the screen shows the day of week and date, and a "close application" icon 13. In the example shown in FIGURE 2, the data display field for the time "12:00" has an ASCII text entry of "LUNCH WITH BOB", previously entered by a user. The image shown in FIGURE 2 is approximately 3" wide by 5" high. It should be clear that it would be difficult for a user to accurately input ink directly into any of the data display fields 11 because of the small size of such fields and the limitations of displays and digitizers, as mentioned previously.

In accordance with the preferred embodiment of the present invention, a user selects a data display field 11 by touching the field with a pen or stylus 3. For example, if the user wishes to make an entry in the data display field 11a opposite the 10:00 label 10, the user would touch a pen anywhere within that data display field 11. Sensing the location of a touch on the display screen 2 by the pen 3 and associating the touch with a data field or window are well-known in the art.

FIGURE 3A is a front plan view of the display screen of the computer of FIGURE 2, showing a first embodiment of an enlarged ink input field or window 14. Referring to FIGURE 3A, a pen touch on the data display field 11a corresponding to the 10:00 label 10a causes the enlarged ink input field 14 to be displayed on the display screen 2. Generation of such fields or windows is well known in the art.

Although shown in FIGURE 3A, the selected data display field 11a could be omitted completely, and the ink input field 14 made even larger, so as to comprise all or substantially all of the available display screen space. Further, other configurations could be used. For example, FIGURE 3B is a front plan view of the display screen of the computer of FIGURE 2, showing an enlarged ink input field 14 that encompasses only the lower portion of the display screen 2, with some or all of the data display fields 11 still being shown. If desired, a dialog box may be displayed to indicate the which data display field 11 has been selected. Alternatively, a symbol 15 may be displayed in the selected data display field 11a to visually indicate its selection.

Any input data already existing in the selected data display field 11a would be shown in the enlarged ink input field 14 at its original input size. In the example shown, the enlarged ink input field 14 would be blank initially. When the enlarged ink input field 14 is displayed, the user may write in the field. The enlarged ink input field 14 may be sized to accommodate only a limited vertical area for ink input, or may be sized to accommodate multiple rows of ink input, as shown in FIGURES 3A and 3B.

Regardless of the size of the enlarged ink input field 14, such field could accommodate additional input from a user by being scrollable. For such purpose, a scroll bar 16 may be provided, in known fashion.

The preferred embodiment also provides soft function keys "INK" 12a, "TEXT" 12b, "CANCEL" 12c, and "OK" 12d, respectively corresponding to an "INK" mode function, a "TEXT" mode function, a "CANCEL OPERATION" function, and an "ACCEPT INPUT"

function. Of course, other labels for such soft keys, and other functions, could be provided.

In the example shown in FIGURE 3A, the "INK" mode 12a icon and "TEXT" mode 12b icon have been provided to allow a user to select or switch between the type of input mode desired. For example, in the "INK" mode, all input is accepted as ink. The user may edit the input as desired. When done, the user presses the "OK" icon 12d to accept the ink input for display in the selected data display field 11a. In the preferred embodiment, the "INK" mode is the default mode, but the user may set another preference in a set-up file, if desired.

In contrast, in the "TEXT" mode, ink input is recognized as the user writes. Again, the user may edit the input as desired. The user indicates completion of input by, for example, "clicking" on the "OK" icon 12d to accept the recognized ink input for display in the selected data display field 11a. Note that the user may save both recognized ink input and unrecognized ink input in a single data display field 11, and can switch between the "INK" mode and the "TEXT" mode as desired by selecting the respective icons 12a, 12b.

In the example shown in FIGURE 3A, the user has entered the phrase "MEETING WITH JEFF AT OFFICE". If the user had selected the "INK" mode icon 12a, all input would be in shown in the enlarged ink input field 14 as ink. If the user had selected the "TEXT" mode icon 12b, all input would be recognized as the user writes. In either event, if the user uses the pen 3 to select the "OK" icon 12d, the input would be saved to the selected data display field 11a.

In the alternative embodiment shown in FIGURE 3B, "INK" and "TEXT" icons 12a', 12b' do not function as mode selectors. Instead, they operate as post-input "SAVE AS INK" and "SAVE AS ASCII TEXT" functions, respectively. For example, referring to FIGURE 3B, the user has entered the phrase "MEETING WITH JEFF AT OFFICE".

When the user is done entering ink input into the enlarged ink input field 14, the user may use the pen 3 to select the "INK" icon 12a' to save the input as an ink data type, or the "TEXT" icon 12b' to have the input recognized and saved as ASCII characters. Alternatively or in addition to the "INK" function key 12a', the user may re-select the original data display field 11a with a touch of the pen 3 to automatically save the contents of the enlarged ink input field 14 as an ink data type. Alternatively, re-selecting the selected data display field 11a can operate to cause the ink input in the enlarged ink input field 14 to be recognized and saved as ASCII characters.

FIGURE 4A is a subsequent view of the display shown in FIGURE 3, showing the selected data display field 11a with multiple "lines" of reduced ink input obtained from the enlarged ink input field 14 of FIGURE 3 ("line" as used here does not refer to ASCII character lines separated by a carriage return/line feed, but to the user's vertical grouping of ink input). The ink input has been reduced in size to fit within the previously selected data display field 11a. Size reduction of ink input can be accomplished in any number of ways known in the prior art. For example, in the preferred embodiment, the ink input is represented as vectors. Hence, the length of each vector stroke comprising each character can be mathematically shortened by a desired amount or percentage, and reduced size characters can then be constructed from the shortened vector representation, in known fashion.

The amount of size reduction of the ink input is preferably fixed at a set value, such as a 2:1 ratio of original input size to reduced size. Alternatively, the size reduction can be user-settable or automatically scaled. In the preferred embodiment, the size reduction for the ink input is limited to an amount that makes the input readable when displayed in the selected data display field 11a.

For automatic scaling, the longest vertical dimension for user input in the enlarged ink input field 14 can be determined as the number of pixels from the top-most pixel to the bottom-most pixel of the ink input. That vertical length is then used to scale

the ink input to fit within the selected data display field 11a. For example, if the vertical length is found to be 200 pixels, and the vertical dimension of the selected data display field 11a is 50 pixels, a 4:1 scaling ratio can be used to reduce the size of the original ink input. Alternatively, the horizontal axis, or both the vertical and horizontal axes, can be used to determine the scaling factor.

As shown in FIGURE 4A, in addition to size reduction of the ink input, the original data display field 11a is resized, either automatically or manually, to show most or all of the ink input. The data display field 11a can be sized to fit all of the ink input, up to the limit of the display screen 2, or sized up to a preset maximum or a maximum set by the user. For example, the data display field 11a may be increased in vertical size by the lesser of the scaled vertical length of the ink input or a fixed number of pixels.

If a substantial amount of ink input was entered in the enlarged ink input field 14 by the user, then a reduced size version of the ink input may not fit entirely within the selected data display field 11a and still be readable, even with resizing of the data display field. FIGURE 4B is a subsequent view of the display shown in FIGURE 3, showing the selected data display field 11a with reduced ink input obtained from the enlarged ink input field of FIGURE 3. As shown in FIGURE 4B, the ink input has been reduced in size to at least partially fit within the previously selected data display field 11a. The data display field 11a containing the ink data type also includes an icon or symbol 17 to indicate that additional input exists in the field, but is not displayed. In this embodiment, touching the icon or symbol 17 enlarges the data display field 11a and provides a scroll bar (not shown) similar to the scroll bar 16 shown in FIGURE 3. Enlarging windows for scrolling, and the scrolling of windows, is well known in the art. In an alternative embodiment, touching the icon or symbol 17 causes the contents of the selected data display field 11a to be displayed in the enlarged ink input field 14.

In the preferred embodiment, the original ink input is always saved in its original form (although it may be compressed in a loss-less manner), regardless of the amount or means of reducing the size of the input for display in a data display field 11. By selecting a data display field 11 containing an ink data type, the original size ink input from the user is redisplayed in the enlarged ink input field 14, for further editing.

FIGURE 4C is a subsequent view of the display shown in FIGURE 3, showing multiple "lines" of reduced ink input obtained from the enlarged ink input field 14 of FIGURE 3. In this embodiment, the original data display field 11a is resized, either automatically or manually, to show more than one "line" of the ink input. In addition, the data display field 11a is re-sized to fit all of the ink input, up to the limit of the display screen 2, or sized up to a preset maximum or a maximum set by the user. In an alternative embodiment, the user may mark the ink input to indicate a range of ink input to display, and the data display field 11a is sized to display the reduced size of that range of ink input, up to some maximum. The selected data display field 11a also includes a scroll bar 18 to indicate that additional input data exists in the field, but is not displayed. Alternatively, an icon or symbol may be provided for such indication.

An important aspect of the invention is that ink input, when reduced and entered into a defined data display field 11, has a context automatically associated with the data. Thus, for example, a user can search for all appointments at 10:00 for the next 30 days. Any data display field 11 meeting those search criteria and having an ink data type entry will be found and displayed, even though the computer cannot search the contents of ink data types. As another example, if the user wants to move an appointment to another day or time, the user would simply change the date or time of the existing appointment, and the associated ink would appear at the new date or time. Prior art systems would require selection of the ink (e.g., by drawing a line or box around the ink), and then cutting and pasting the selected ink into a new area.

FIGURE 5 is a subsequent view of the display shown in FIGURE 4, showing the converted form of the reduced ink input of FIGURE 4 in the selected data display field 11a. If the user accepts the ink input in the enlarged ink input field 14 for recognition, then the computer recognizes the ink input as ASCII text characters, and displays the text characters in the data display field 11a. The computer can directly search the contents of data display fields 11 containing ASCII text characters, in known fashion.

Referring to FIGURE 5, the selected data display field 11a may also include an icon or symbol 17 to indicate that additional input data exists in the field, but is not displayed. In this embodiment, touching the icon or symbol 17 enlarges the data display field 11a and provides a scroll bar (not shown) similar to the scroll bar 16 shown in FIGURE 3.

The user can also recognize reduced ink input in a selected data display field 11a at a later time. To do so in the preferred embodiment, the user selects a data display field 11a, causing the contents to be displayed in the enlarged ink input field 14. The user then selects the "TEXT" icon 12b (shown in FIGURE 3A) to have the input recognized as ASCII characters. However, any other means may be used to activate the recognition function to operate on the contents of the selected data display field 11a.

Because inputing ink into the enlarged ink input field 14 is very fast compared to recognition, the invention permits a user to enter data essentially as rapidly as the user can write. At a later time, the user can convert the data to ASCII text characters if desired.

FIGURE 6 is a flow chart describing the preferred embodiment of the inventive process of the present invention. The basic steps are:

1. The computer senses the user's pen touch on a defined data display field 11a, and accepts that touch as a selection of the field (STEP 100).
2. The enlarged ink input field 14 is opened for user input (STEP 102).

3. The computer tests for the presence of the pen 3 within the enlarged ink input field 14 (STEP 104).

4. If the pen 3 is in the enlarged ink input field 14, then the computer tests if the system is in the "INK" mode (STEP 106).

   a. If yes, then the ink is displayed in the enlarged ink input field 14, and processing continues at STEP 104.

   b. If no, then:

      1) the ink is recognized (STEP 110) by processing the ink through a character recognition algorithm (such as the character recognition system described in U.S. Patent No. 5,125,039, entitled "Object Recognition System", by the inventor of the present invention);

      2) the recognized text is displayed in the enlarged ink input field 14 (STEP 112);

      3) processing continues at STEP 104.

5. If the pen was not in the enlarged ink input field 14 (STEP 104), then the computer tests if the pen 3 is touching the "TEXT" icon 12b (STEP 114).

6. If the pen 3 is in the "TEXT" icon, then the computer tests if the system is in the "INK" mode (STEP 116).

   a. If no, then processing continues at STEP 104.

   b. If yes, then:

      1) the existing ink in the enlarged ink input field 14 is recognized (STEP 118);

      2) the enlarged ink input field 14 is cleared of ink (STEP 120);

      3) the recognized text is displayed in the enlarged ink input field 14 (STEP 122);

      4) the mode is changed to "TEXT" (STEP 124);

      5) processing continues at STEP 104.

7. If the pen 3 is not in the "TEXT" icon, then the computer tests if the pen 3 is touching the "INK" icon 12a (STEP 126).

8. If the pen 3 is in the "INK" icon, then the computer tests if the system is in the "TEXT" mode (STEP 128).
   a. If no, then processing continues at STEP 104.
   b. If yes, then:
      1) the enlarged ink input field 14 is cleared of text (STEP 130);
      2) the mode is changed to "INK" (STEP 132);
      3) processing continues at STEP 104.
9. If the pen 3 is not in the "INK" icon, then the computer tests if the pen 3 is touching the "OK" icon 12d (STEP 134).
10. If the pen 3 is in the "OK" icon, then:
   a. the enlarged ink input field 14 is closed (STEP 136);
   b. the input (text or ink, depending on mode) is displayed in the selected data display field (STEP 138).
11. If the pen 3 is not in the "OK" icon, then the computer tests if the pen 3 is touching the "CANCEL" icon 12c (STEP 140).
   a. If no, then processing continues at STEP 104;
   b. If yes, then the enlarged ink input field 14 is closed (STEP 142).

FIGURE 7 is a flow chart describing a second embodiment of the inventive process of the present invention. The basic steps are:

1. The computer senses the user's pen touch on a defined data display field 11a, and accepts that touch as a selection of the field (STEP 200).
2. The enlarged ink input field 14 is opened for user input (STEP 202).
3. The computer senses the user's pen touch within the enlarged ink input field 14 as ink input (STEP 204).
4. If the user accepts the ink input for display (e.g., by touching the "INK" soft key 12a) (STEP 206), then:
   a. The enlarged ink input field 14 is closed (STEP 208) (this step could be performed after the next step);
   b. The ink input is reduced in size (STEP 210); and

c. The reduced ink input is displayed in the selected data display field 11a (STEP 212).

5. If the user accepts the ink input for recognition (e.g., by touching the "TEXT" soft key 12b) (STEP 214), then:

a. The enlarged ink input field 14 is closed (STEP 216) (this step could be performed after the next step);

b. The ink input is processed through a character recognition algorithm (STEP 218);

c. The recognized ASCII text is displayed in the selected data display field 11a (STEP 220).

In an alternative embodiment of the invention, the user does not first select a data display field and then input data into an associated enlarged ink input field. Instead, the user selects or invokes a function that displays an enlarged ink input field, inputs ink data, and then associates the input with a selected data display field. Thus, the step described above of selecting a data display field need not be done in the strict order indicated.

In summary, the invention allows a user to enter data quickly into a larger writing field but display the data in a smaller viewing field. Importantly, the ink data is useful to the user and the computer because the data is entered into defined input fields, and thus a context is automatically associated with the data. Further, the invention permits a user to enter data as rapidly as the user can write, and convert the data to text characters at a later time.

A number of embodiments of the present invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. For example, although the invention has been described in the context of a portable computer, the invention can be applied to pen-based computers embedded within other equipment or structures. According-

ly, it is to be understood that the invention is not to be limited by the specific illustrated embodiment, but only by the scope of the appended claims.

CLAIMS

1. A data input system for a pen-based computer having a display and writing area, at least one pre-defined data display field, and means for accepting pen input from a user as ink, the data input system including:

   (1) means for accepting selection by a user of a pre-defined data display field;

   (2) means for displaying an enlarged ink input field;

   (3) means for accepting ink input from the user in the enlarged ink input field;

   (4) means for reducing the size of the ink input;

   (5) means for displaying at least part of the reduced-size ink input in the selected data display field.

2. The data input system of claim 1, further including:

(1) means for recognizing the ink input as text;

(2) means for displaying the recognized text in the selected data display field.

3. The data input system of claim 1, further including means for sizing the enlarged ink input field to accept multiple lines of ink input from the user.

4. The data input system of claim 3, wherein the enlarged ink input field is scrollable.

5. The data input system of claim 1, wherein the enlarged ink input field includes substantially all of the available writing area of the computer.

6. The data input system of claim 1, further including means for indicating that the selected data display field contains more reduced-size ink input than is displayed in the selected data display field.

7. The data input system of claim 1, further including means for sizing the selected data display field to display multiple lines of reduced-size ink input.

8. The data input system of claim 7, wherein the selected data display field is scrollable.

9. The data input system of claim 7, further including means for marking a portion of the ink input to limit display of the reduced-size ink input to the marked portion.

10. The data input system of claim 1, further including means for sizing the selected data display field to display essentially all of the reduced-size ink input.

11. The data input system of claim 10, wherein the selected data display field is scrollable.

12. The data input system of claim 10, further including means for marking a portion of the ink input to limit display of the reduced-size ink input to the marked portion.

13. A method for inputing data into a pen-based computer having a display and writing area, at least one pre-defined data display field, and means for accepting pen input from a user as ink, the method including the steps of:

(1) accepting selection by a user of a pre-defined data display field;

(2) displaying an enlarged ink input field;

(3) accepting ink input from the user in the enlarged ink input field;

(4) reducing the size of the ink input;

(5) displaying at least part of the reduced-size ink input in the selected data display field.

14. The method of inputing data of claim 13, further including the steps of:
    (1) recognizing the ink input as text;
    (2) displaying the recognized text in the selected data display field.

15. The method of inputing data of claim 13, further including the step of sizing the enlarged ink input field to accept multiple lines of ink input from the user.

16. The method of inputing data of claim 15, wherein the enlarged ink input field is scrollable.

17. The method of inputing data of claim 16, wherein the enlarged ink input field includes substantially all of the available writing area of the computer.

18. The method of inputing data of claim 13, further including the step of indicating that the selected data display field contains more reduced-size ink input than is displayed in the selected data display field.

19. The method of inputing data of claim 13, further including the step of sizing the selected data display field to display multiple lines of reduced-size ink input.

20. The method of inputing data of claim 19, wherein the selected data display field is scrollable.

21. The method of inputing data of claim 13, further including the steps of:
    (1) providing means to mark a portion of the ink input;
    (2) limiting display of the reduced-size ink input to the marked portion.

22. The method of inputing data of claim 13, wherein the step of accepting selection by a user of a pre-defined data display field is performed after the step of accepting ink input from the user in the enlarged ink input field.

23. The method of inputing data of claim 13, further including the step of sizing the selected data display field to display essentially all of the reduced-size ink input.

24. The method of inputing data of claim 23, wherein the selected data display field is scrollable.

AMENDED CLAIMS

[received by the International Bureau on 19 April 1994 (19.04.94); original claims 1 and 13 amended; remaining claims unchanged (2 pages)]

1. A data input system for a pen-based computer having a display and writing area, at least one pre-defined structured data display field, and means for accepting pen input from a user as ink, the data input system including:

(1) means for accepting selection by a user of a pre-defined structured data display field;

(2) means for creating and displaying a temporary enlarged ink input field, the contents of which correspond to the contents of the selected data display field, the enlarged ink input field being larger than the selected data display field;

(3) means for accepting ink input from the user in the enlarged ink input field;

(4) means for terminating display of the enlarged ink input field;

(5) means for displaying at least part of the ink input in reduced size in the selected data display field; and

(6) means for manipulating the ink input indirectly by directly manipulating the structured data display field.

13. A method for inputing data into a pen-based computer having a display and writing area, at least one pre-defined structured data display field, and means for accepting pen input from a user as ink, the method including the steps of:

(1) accepting selection by a user of a pre-defined data display field;

(2) creating and displaying a temporary enlarged ink input field, the contents of which correspond to the contents of the selected data display field, the enlarged ink input field being larger than the selected data display field;

(3) accepting ink input from the user in the enlarged ink input field;

(4) terminating display of the enlarged ink input field;

(5) displaying at least part of the ink input in reduced size in the selected data display field; and

(6) manipulating the ink input indirectly by directly manipulating the structured data display field.

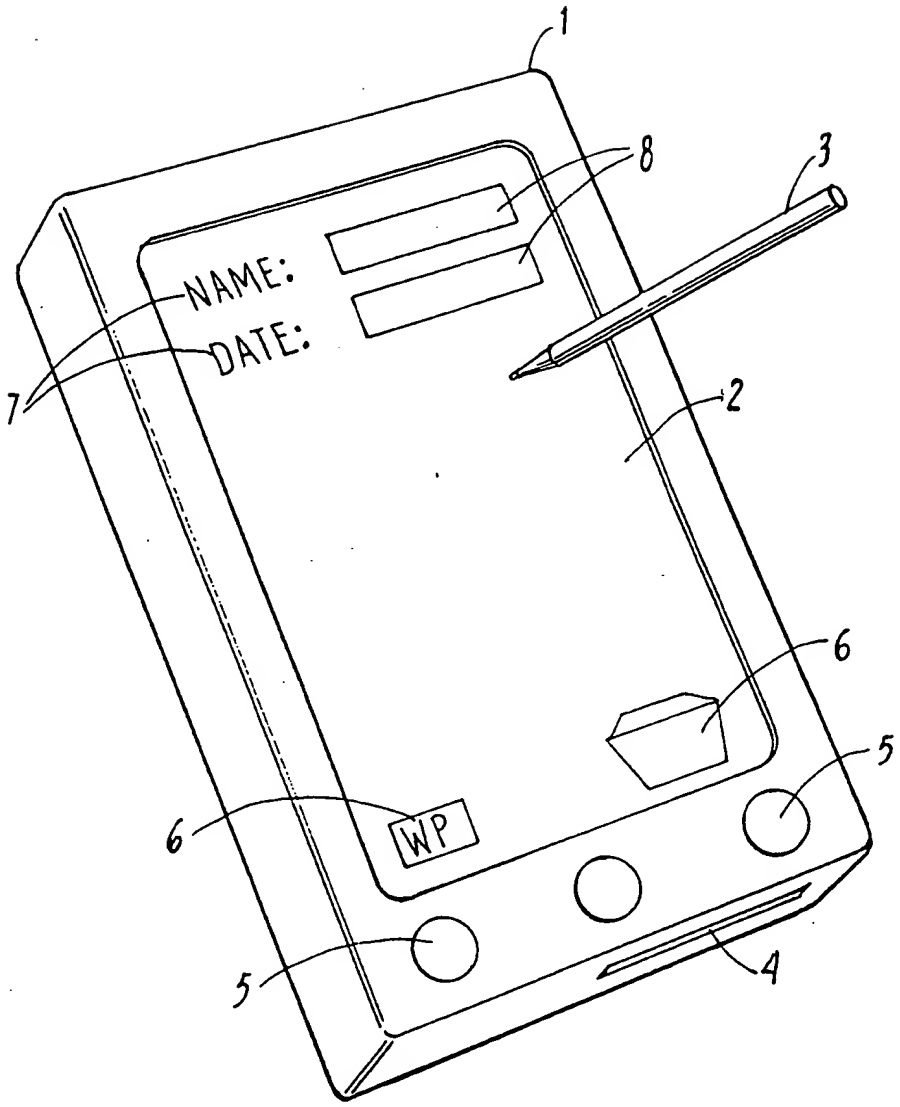


Fig. 1

(PRIOR ART)

Fig. 2

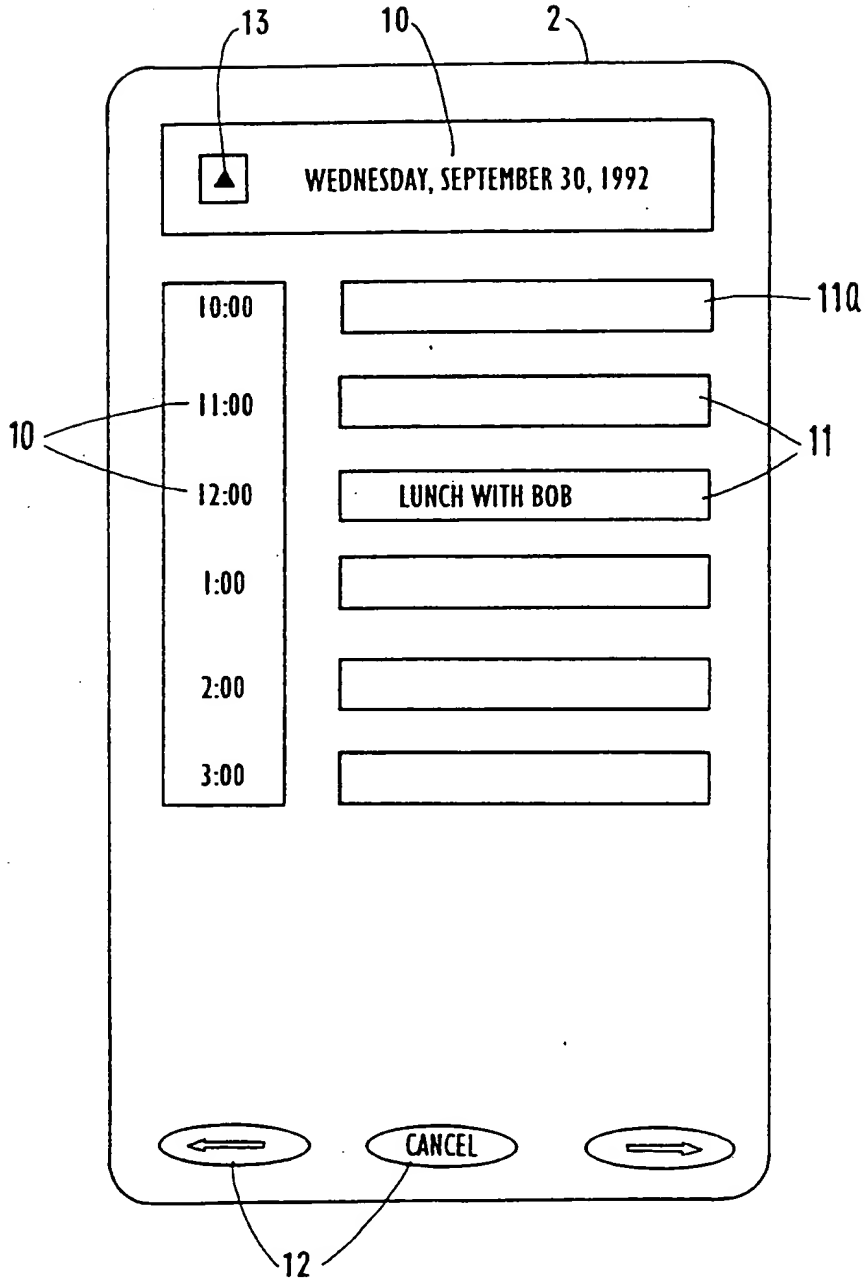

13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
10:00
11:00
12:00
1:00
2:00
3:00
11a
10
11
LUNCH WITH BOB
CANCEL
12

Fig. 3A

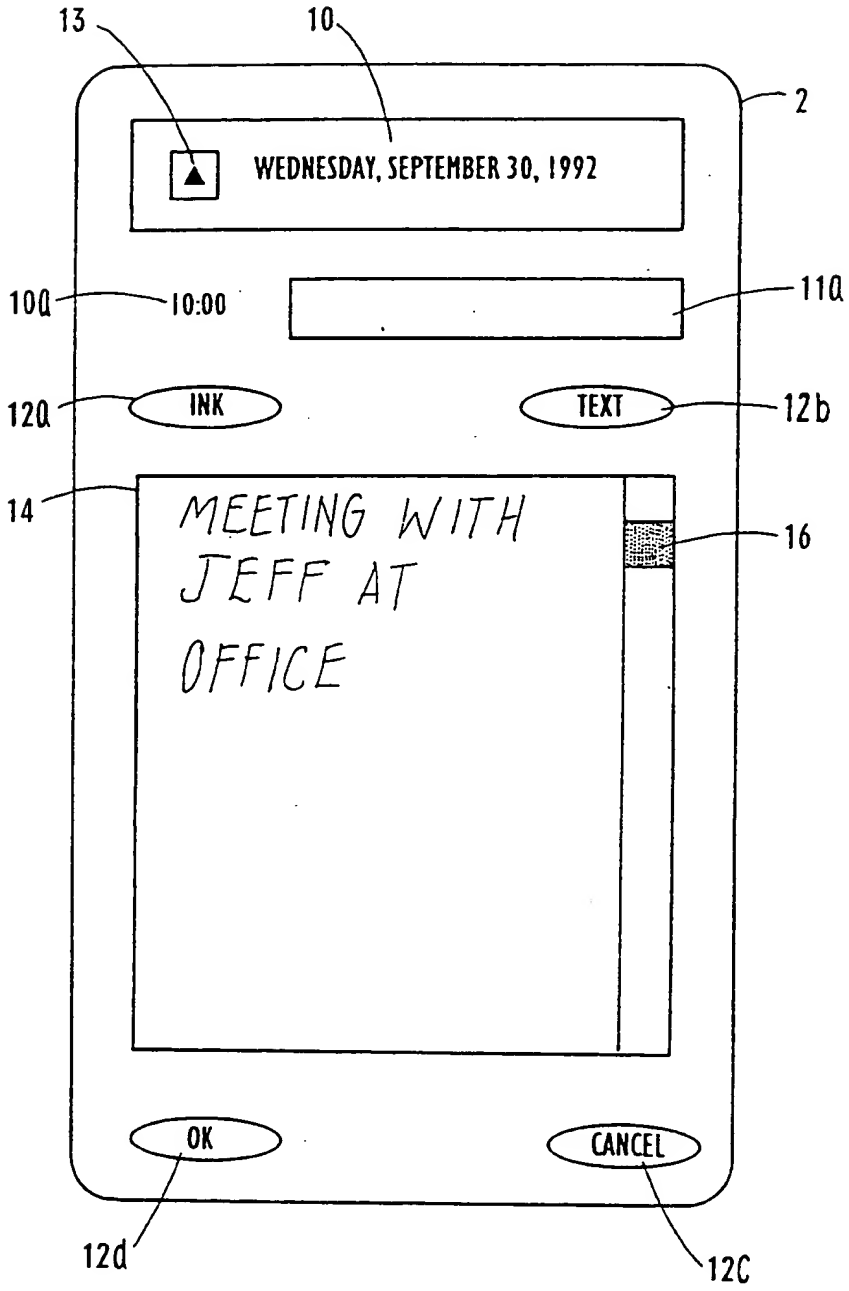

13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
10a
10:00
11a
12a
INK
TEXT
12b
14
MEETING WITH JEFF AT OFFICE
16
OK
CANCEL
12d
12c

Fig. 3B

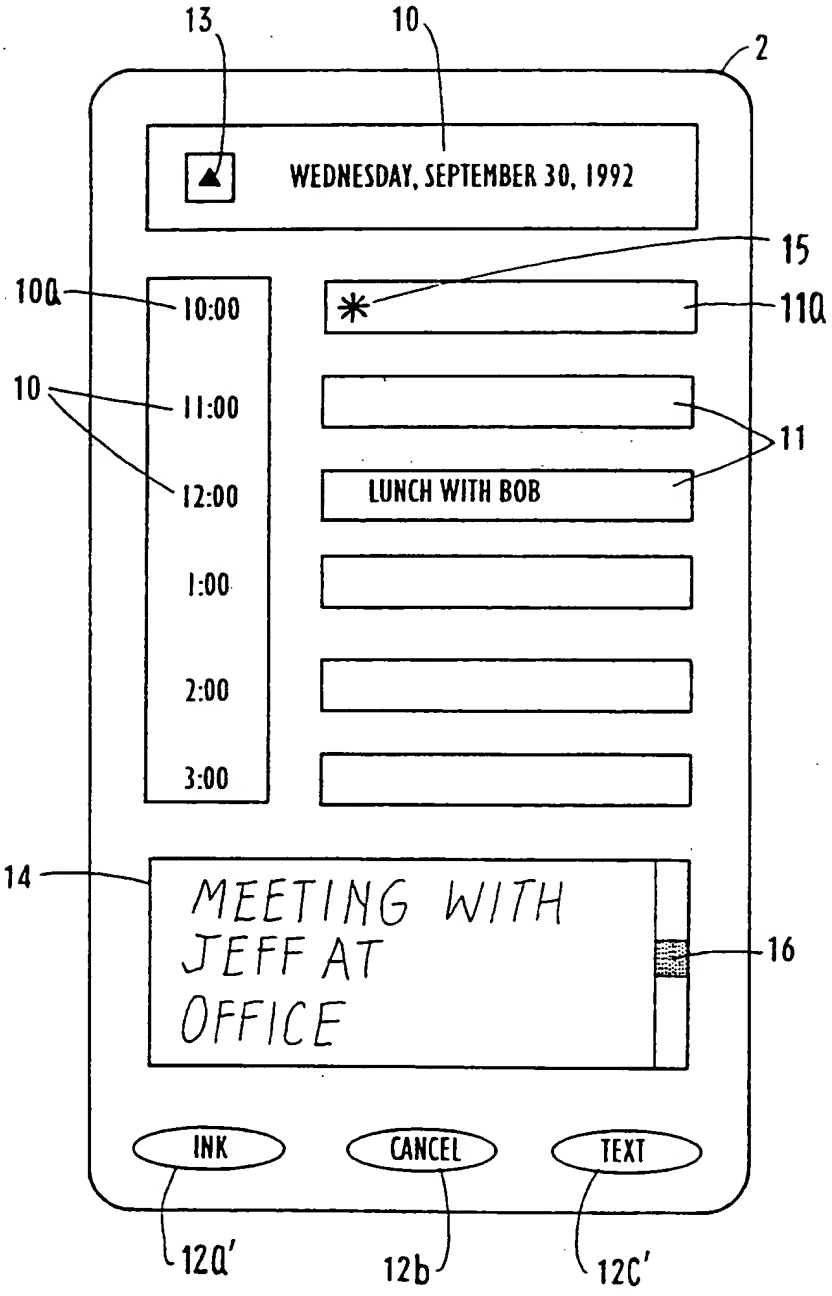

13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
15
10a
10:00
11a
10
11:00
11
12:00
LUNCH WITH BOB
1:00
2:00
3:00
14
MEETING WITH JEFF AT OFFICE
16
INK
CANCEL
TEXT
12a'
12b
12c'

Fig. 4A

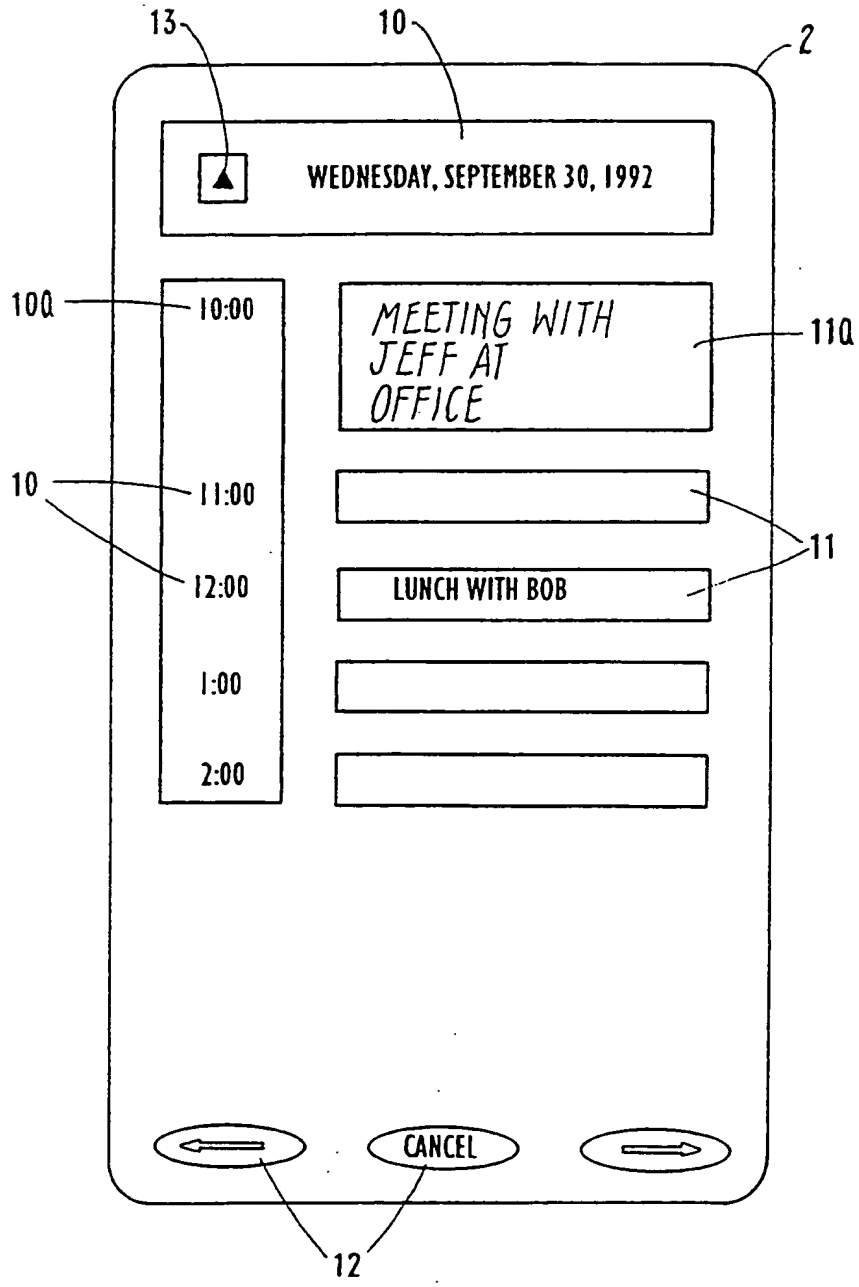

13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
10Q
10:00
MEETING WITH JEFF AT OFFICE
11Q
10
11:00
12:00
LUNCH WITH BOB
11
1:00
2:00
CANCEL
12

Fig. 4B

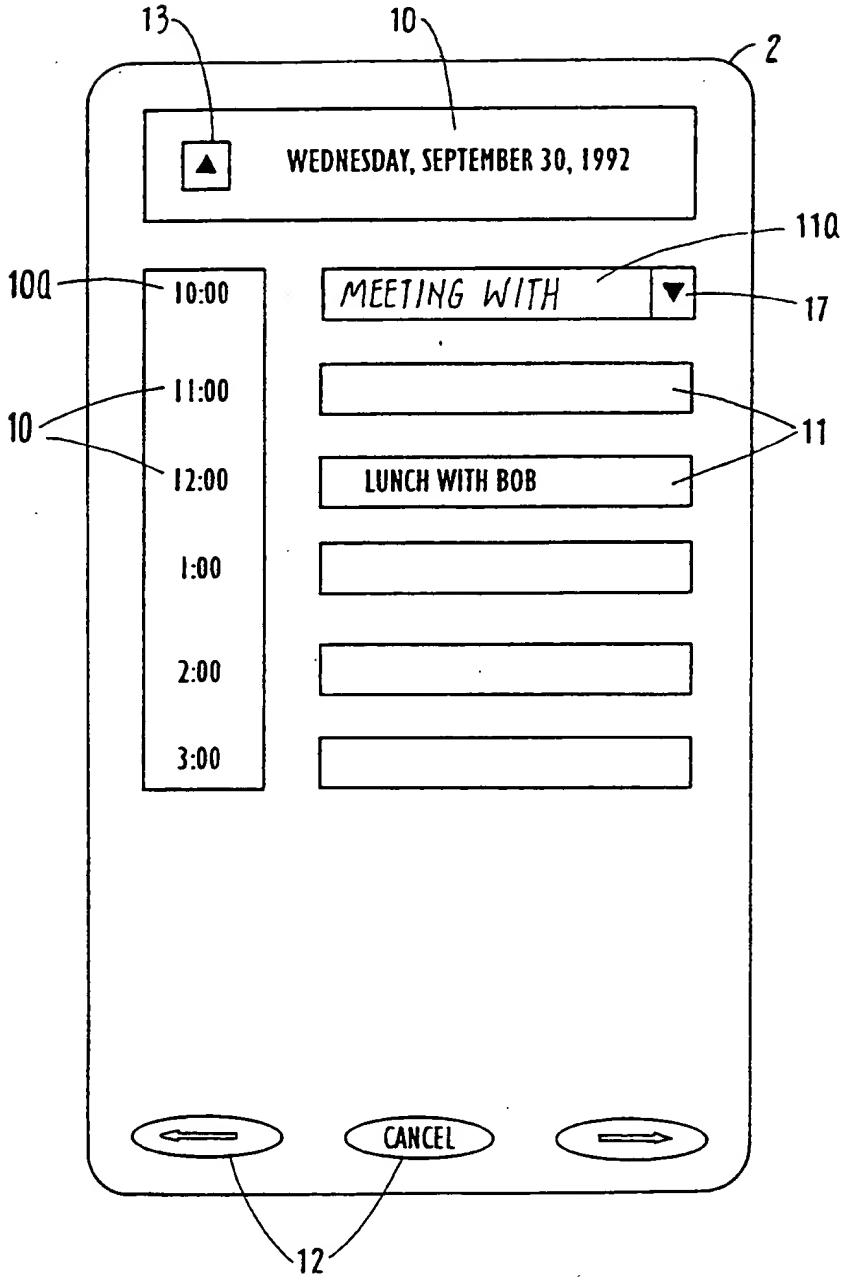

13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
11a
10a
10:00
MEETING WITH
17
11:00
10
11
12:00
LUNCH WITH BOB
1:00
2:00
3:00
CANCEL
12

Fig. 4C

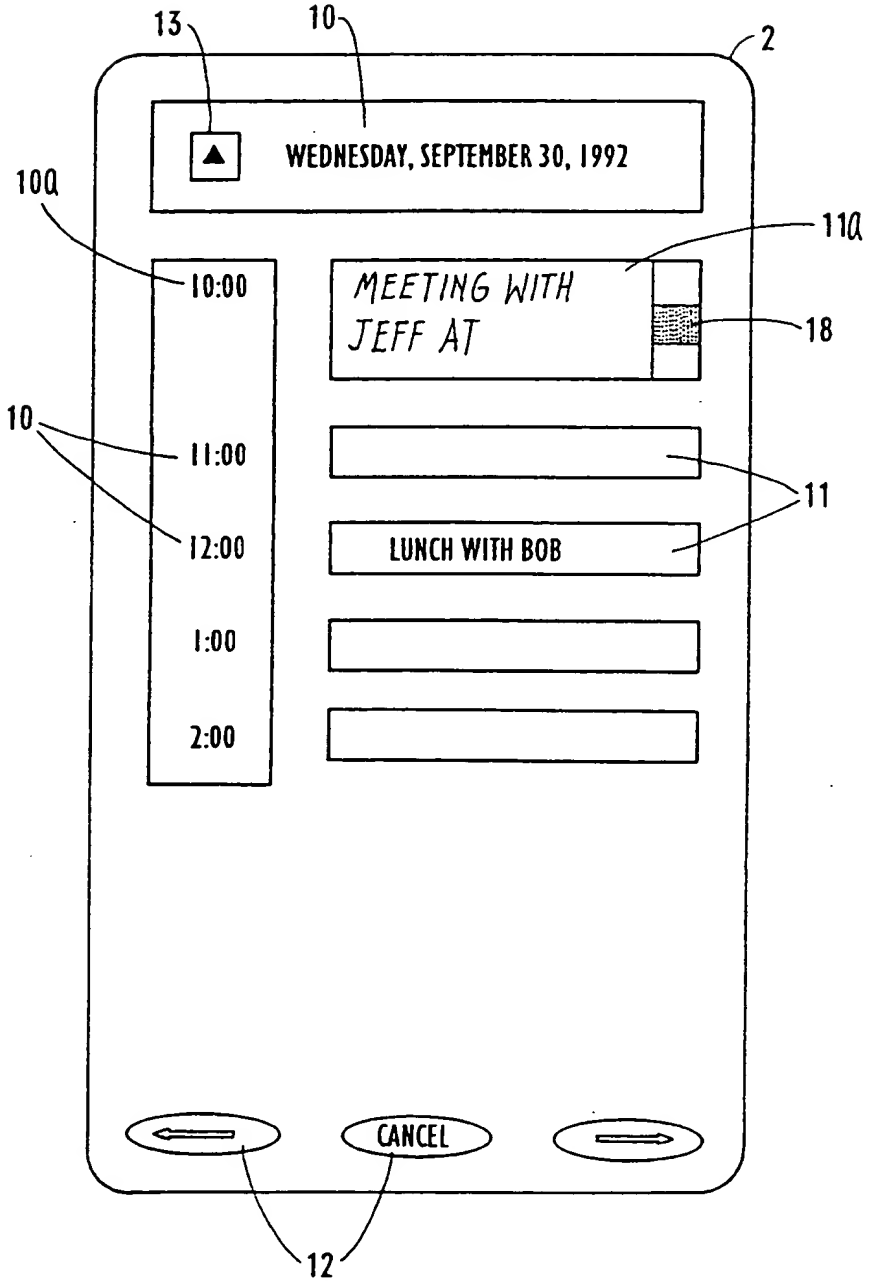
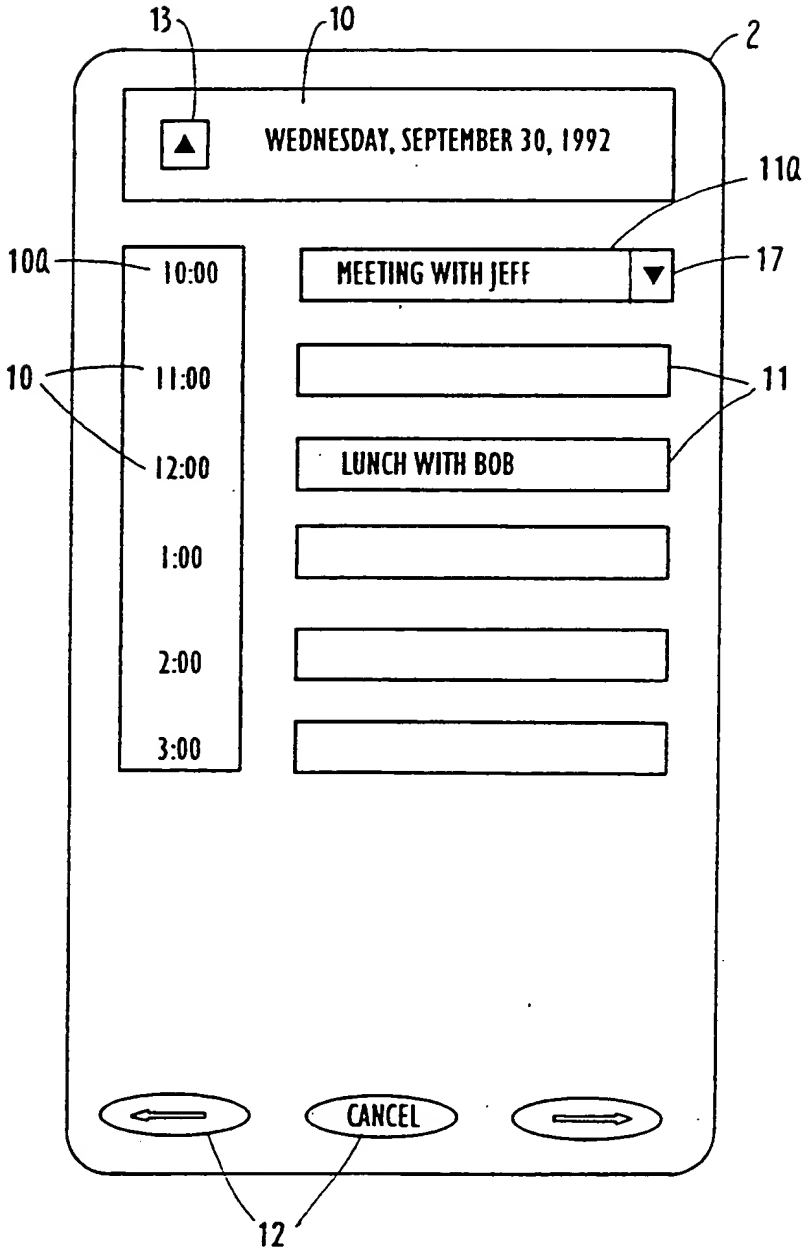

13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
10a
11a
10:00
MEETING WITH
JEFF AT
18
10
11:00
11
12:00
LUNCH WITH BOB
1:00
2:00
CANCEL
12

Fig. 5


13
10
2
WEDNESDAY, SEPTEMBER 30, 1992
11a
10a
10:00
MEETING WITH JEFF
17
10
11:00
11
12:00
LUNCH WITH BOB
1:00
2:00
3:00
CANCEL
12

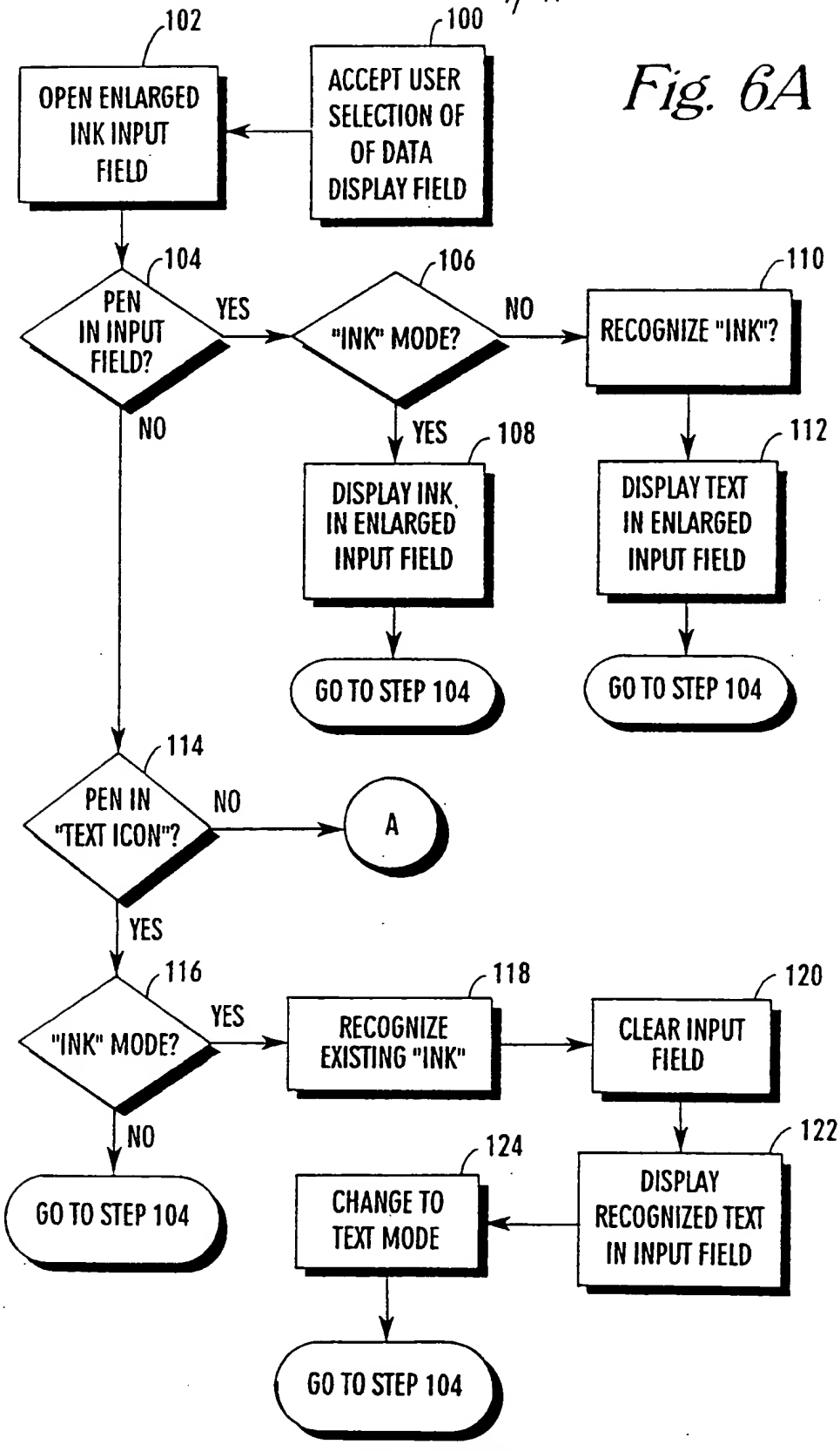
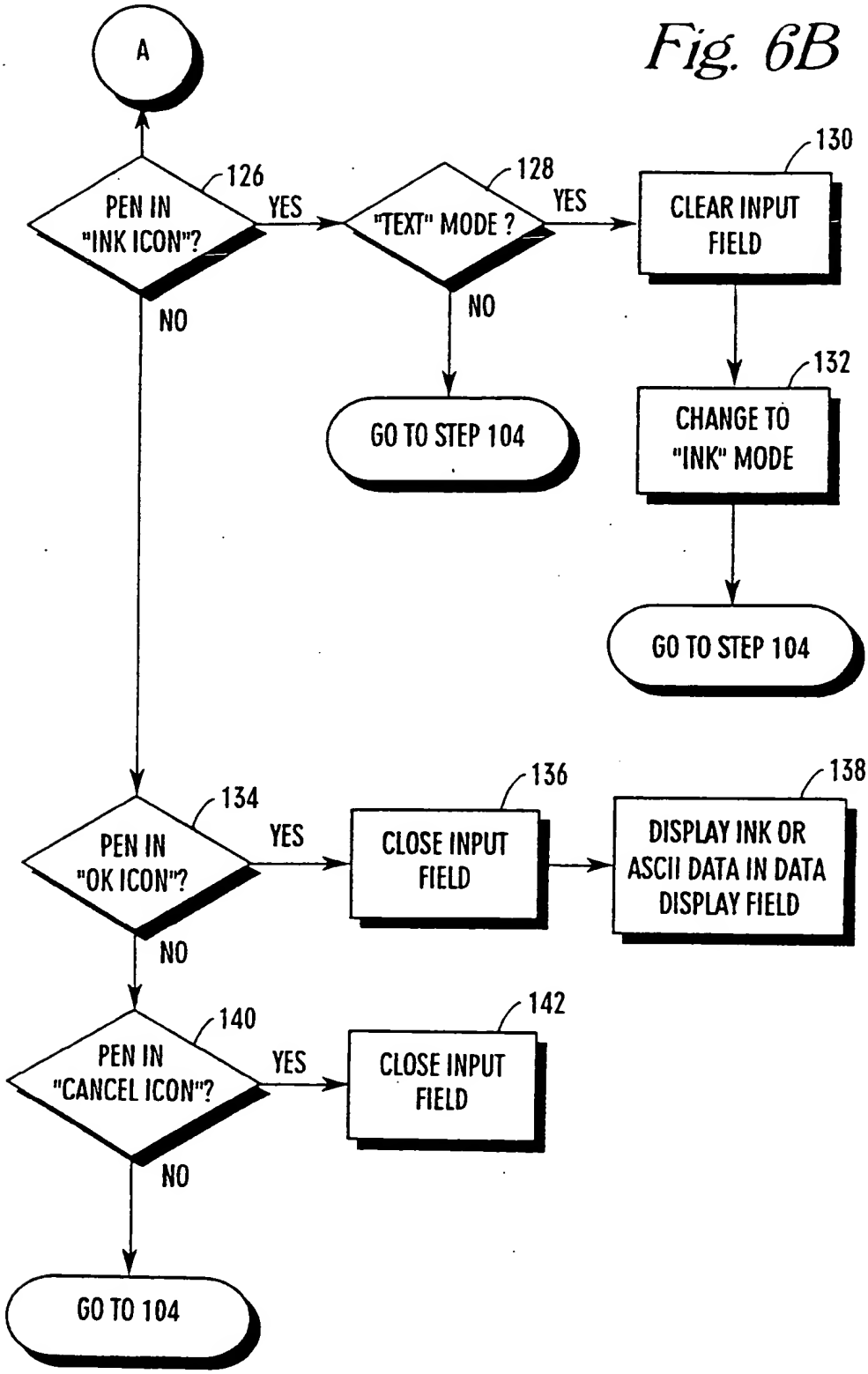

100
ACCEPT USER SELECTION OF OF DATA DISPLAY FIELD
102
OPEN ENLARGED INK INPUT FIELD
104
PEN IN INPUT FIELD?
YES
NO
106
"INK" MODE?
NO
YES
110
RECOGNIZE "INK"?
108
DISPLAY INK IN ENLARGED INPUT FIELD
112
DISPLAY TEXT IN ENLARGED INPUT FIELD
GO TO STEP 104
GO TO STEP 104
114
PEN IN "TEXT ICON"?
NO
A
YES
116
"INK" MODE?
YES
NO
118
RECOGNIZE EXISTING "INK"
120
CLEAR INPUT FIELD
122
DISPLAY RECOGNIZED TEXT IN INPUT FIELD
124
CHANGE TO TEXT MODE
GO TO STEP 104
GO TO STEP 104

Fig. 6A

Fig. 6B


A
126
PEN IN "INK ICON"?
YES
128
"TEXT" MODE ?
YES
130
CLEAR INPUT FIELD
NO
NO
GO TO STEP 104
132
CHANGE TO "INK" MODE
GO TO STEP 104
134
PEN IN "OK ICON"?
YES
136
CLOSE INPUT FIELD
138
DISPLAY INK OR ASCII DATA IN DATA DISPLAY FIELD
NO
140
PEN IN "CANCEL ICON"?
YES
142
CLOSE INPUT FIELD
NO
GO TO 104

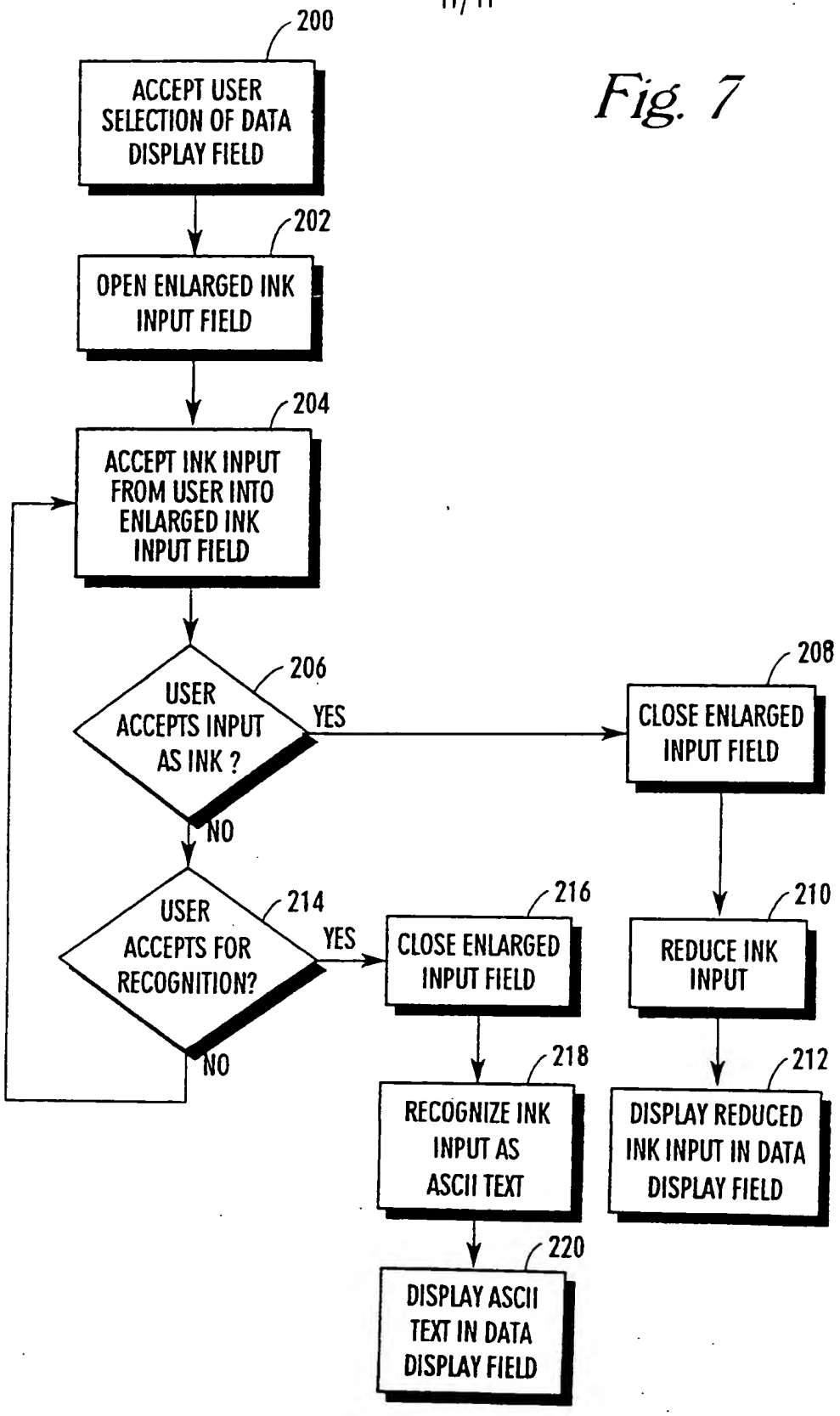

200
ACCEPT USER SELECTION OF DATA DISPLAY FIELD
202
OPEN ENLARGED INK INPUT FIELD
204
ACCEPT INK INPUT FROM USER INTO ENLARGED INK INPUT FIELD
206
USER ACCEPTS INPUT AS INK ?
YES
NO
208
CLOSE ENLARGED INPUT FIELD
210
REDUCE INK INPUT
212
DISPLAY REDUCED INK INPUT IN DATA DISPLAY FIELD
214
USER ACCEPTS FOR RECOGNITION?
YES
NO
216
CLOSE ENLARGED INPUT FIELD
218
RECOGNIZE INK INPUT AS ASCII TEXT
220
DISPLAY ASCII TEXT IN DATA DISPLAY FIELD

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/10587

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :G09G 5/14
US CL : 345/173
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/173, 156, 177, 179, 180, 182, 127, 129, 130, 123; 178/18, 19

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,063,600 (Norwood) 05 November 1991, figures 1B and 2-15; column 9, lines 53-68; column 12, lines 11-34; column 24, lines 19-27; column 27, lines 15-34; and column 29, lines 16-22.	1-24
A	US, A, 5,157,737 (Sklarew) 20 October 1992 , figure 2, and column 5, lines 62-68.	1, 2, 13 and 14
A	JP, A, 58-114287 (Nishimura) 07 July 1983, figure and constitution.	1, 2, 13 and 14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 December 1993	FEB 23 1994
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer LAO, LUN-YI Telephone No. (703) 305-4700

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